

REMARKS

The non-final Office Action mailed June 8, 2010, has been carefully reviewed. From the Summary page, claims 1-14 were pending and indicated as rejected. Acknowledgment has been made of Applicants' claim for priority. Further, the Information Disclosure Statements filed July 12, 2006, and August 29, 2008, have been considered.

Notification of the status of the Drawings is absent. Applicants kindly request that such a notification for the Drawings be made in the next Action.

By this response, claims 3-6 and 9-14 have been canceled. Claims 1 and 2 have been amended. New claims 15 through 25 have been added. New dependent claim 15 further defines the metallic compound of claim 1 which is used as a gate electrode. New independent claim 16 describes a method for manufacturing the semiconductor device recited in claim 1. New claim 17 is similar in scope with claim 2 but depends upon claim 16. New claims 18-24 further define the material used for manufacturing the semiconductor device. New claim 25 is similar to new claim 15 but depends upon new claim 16. No statutory new matter has been added. Support for all amendments can be found in the original disclosure.

Claim Rejection under 35 U.S.C. § 103(a)

Claims 1-5 and 7 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ilg et al. (USPN 6130145). The rejection as to claims 3-5 is moot upon cancellation. The rejection as to claims 1-2 and 7 is respectfully traversed.

Amended claim 1 recites,

"A semiconductor device comprising:

a semiconductor substrate;

a gate insulator formed on the substrate; and

a gate electrode having a metallic compound film, the gate electrode being formed on the insulator, wherein

the metallic compound film contains a metal and at least one of Si and N, and

the content of at least one of Si and N in the metallic compound film is such that the work function of the metallic compound film is in the mid-gap of Si.”

Applicants make reference to their preferred embodiment shown in FIG. 1. Specifically, a gate electrode 3 is formed on a gate oxide film 2 which is formed on a silicon substrate 1. The gate electrode contains a metallic compound film 3a which is made of tungsten (W). See para. [0034] of Applicants’ PG Publ. 2009/0085130. The metal compound film also contains at least one of Si and N. The metallic compound film used in the semiconductor device is defined by a work function that is in the mid-gap of Si (e.g., 4.6 eV). See para. [0036], See also FIG. 2. According to Applicants, this provides for regulation of the threshold voltage of the gate electrode to a desired value.

A device having Applicants’ claimed gate electrode with a metallic film is not disclosed by the applied art. The Office Action describes Ilg as having a metallic compound film of WSi_x . The Office Action admits, however, that Ilg et al. does not suggest controlling the work function by changing the content of at least one of Si and N in the metallic compound film. Therefore, Ilg fails to disclose Applicants’ device where the metallic compound film contains sufficient Si and/or N to provide it with the recited Si mid-gap work function. The rejection thus must fail for this reason.

The Action goes on to allege that it is “well known in the art of manufacturing semiconductor devices to control the work function of a metallic compound film by increasing the concentration/content of nitrogen because the work function increases with increased nitrogen content in the metallic compound film”. It refers to Maiti et al., USPN 6027961 col. 4 lines 49-56, in this regard. Maiti, however, was not made part of the Examiner’s rejection under 35 U.S.C. § 103(a). Moreover, the Examiner has given no reasons why one of ordinary skill in the art would have looked to Maiti in connection with increasing the work function in Ilg’s metallic compound film of WSi_x , in order to arrive at (Applicants’) gate electrode containing a “metallic compound film... such that the work function of the metallic compound film is in the mid-gap of Si” (e.g., 4.6 eV). For at least these reasons, withdrawal of the rejection as to claim 1, and claims 2 and 7 depending therefrom, is kindly solicited by Applicants.

Claims 6 and 8-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ilg in view of Komatsu (JP 10303412). The rejection as to claims 6, and 9-14 is moot upon cancellation. The rejection as to claim 8 is traversed.

Applicants submit that Komatsu does not remedy the deficiencies of Ilg et al. with respect to amended claim 1. Similar arguments for claim 1, from which claim 8 depends, are submitted herein to patentably distinguish claim 8 over the combination of Ilg and Komatsu. For at least these reasons, the obviousness rejection as to claim 8 must fail. Withdrawal of the rejection as to claim 8 is kindly requested by Applicants.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Therefore it is respectfully requested that the Examiner reconsider all of the presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

It is not believed that extensions of time are required, beyond those that may otherwise be provided for in accompanying documents. However, in the event that additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a), and any fees required therefore are hereby authorized to be charged to **Deposit Account No. 02-4300, Attorney Docket No. 033082 M 334.**

Respectfully submitted,
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